The Northwestern MILLER
MILLING PRODUCTION SECTION

Industrial Utilization of Wheat and Flour

By Dr. F. R. Senti

THE capacity of American farmers to produce more wheat than can be disposed of profitably in both domestic and foreign outlets was again demonstrated last year when 400 million bushels in excess of needs were harvested from 54 million acres. The carryover forecast for July 1, 1959, has now accumulated to an imposing 1.3 billion bushels. In the search for ways to bring wheat production and its use into balance, particular emphasis is presently being given to extending its industrial utilization.

This discussion considers the problem of increasing industrial outlets for wheat, outlines the research on this problem now underway at the Northern Utilization Research and Development Division of the Agricultural Research Service at Peoria, and indicates future research needed for the development of further industrial outlets. First, as a background, present industrial uses of wheat will be pointed out.

EDITOR'S NOTE: Dr. Senti is director of the Northern Utilization Research and Development Division at Peoria, Ill., one of the divisions of the Agricultural Research Service of the U.S. Department of Agriculture. He presented this report before the recent 63rd annual technical conference of the Association of Operative Millers at Chicago.

Present Uses

Over the past five years an average of one half million bushels of wheat has been used annually to produce alcohol. In 1957, the President's Commission on Increased Industrial Use of Agricultural Products reported that about 5 million bushels a year are required to produce starch and gluten by wet milling. Formerly, some 20 million pounds of gluten were used annually in making monosodium glutamate, but cheaper sources for it are now available from Steffen's waste and by fermentation processes. Wheat starch retains its market for household and commercial laundry use, and modified starch continues to be used as a warp size in textile manufacture. Wheat flour is preferred for wallpaper and billboard pastes. The softer cold gel of wheat starch is desired for some food uses. Gluten is used to upgrade low-protein flour for bread, to prepare high protein breads, and in recent years to fortify high protein breakfast cereals.

Wheat germ oil is a valuable pharmaceutical priced at $12 lb. It is valued for its vitamin E content, but production is apparently small because of limited markets.

Increasing industrial outlets of wheat through utilization research and development is, indeed, a challenging problem. First of all, as a food grain, wheat commands a higher price than the feed grains. Table I shows this difference along with accumulated carryovers of the cereal grains. At present support levels, wheat is priced at 50% more than corn and 100% more than grain sorghum.

TABLE I. CARRYOVER AND AVERAGE SUPPORT PRICES OF CEREAL GRAINS[1]

Cereal	Carryover, June 1959[2]	Support price per bu. 1959
	Million bu.	Dollar
Food Grains		
Wheat	59	60.55
Rice	0.59	87.60
Feed Grains		
Corn	50	40.00
Grain sorghum	15	30.40
Oats	6	31.25
Barley	5	30.11
Rye	0.41	30.15
Total	136	

[1] USDA, AMS: Feed, Wheat, and Rice Situations.
[2] Corn and sorghum year ends September 30, 1959; rice, July 31, 1959; others, June 30, 1959.

The three surplus grains — corn, wheat, and sorghum—are competitive from the standpoint of composition.

TABLE II. AVERAGE PERCENTAGE COMPOSITION OF SURPLUS CEREAL GRAINS[1]

Grain	Starch	Protein	Oil	Fiber	Minor Constituents[2]
Hard wheat	64	15	2	2	17
Soft wheat	67	12	2	2	17
Dent corn	72	10	5	2	11
Sorghum	71	13	5	0	11

[1] Moisture-free basis
[2] Minerals, sugars, pentosans, vitamins, etc

Table II compares the composition of these three cereals. Industrial applications of grains depend largely on their major components—starch and protein—and their properties. Preference for wheat as an industrial raw material must rely largely on the unique properties of these two components.

The granular structure of corn and sorghum starches is nearly identical in size ranging from 10 to 25 microns; wheat starch granules range from 2 to 35 microns in diameter and contain a large number of small granules. These differences are illustrated in Fig. 1. Once the structure of these cereal starches is destroyed, their properties are quite similar. The slipperiness and high-water retention of wheat starch give it preferred properties for wallpaper and billboard pastes; these properties are attributed to the large percentage of small granules. The size range in granules, as well as their pure whiteness, offers an explanation why wheat starch is preferred for laundry use; the small granules are believed to penetrate fabrics while the large ones coat exterior surfaces.

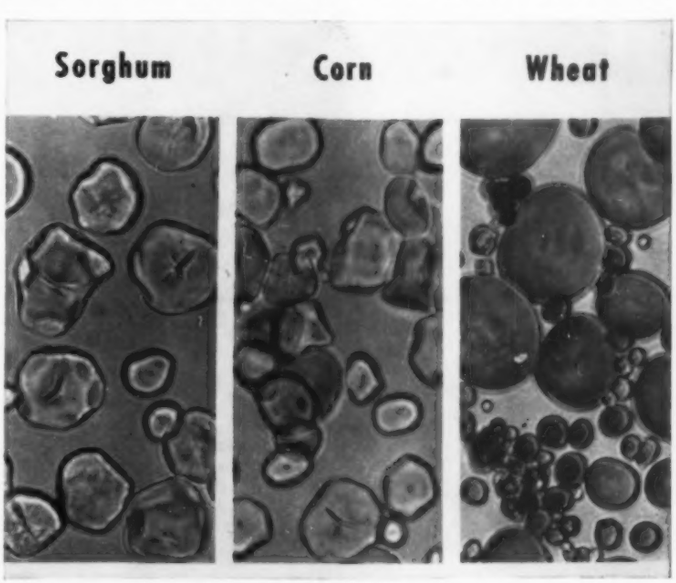


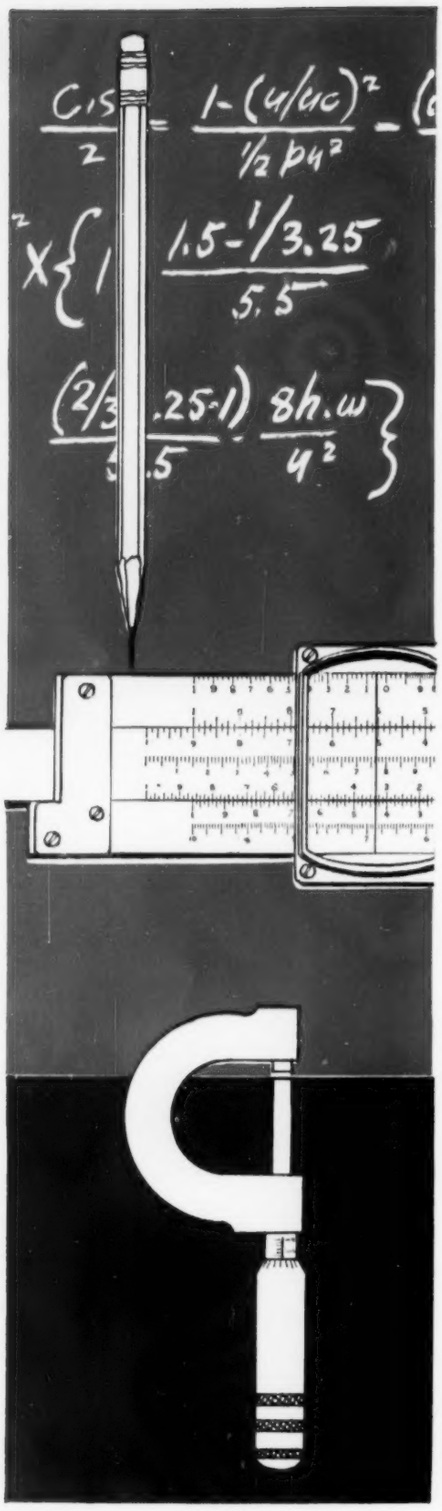
FIG. 1. Comparison of starch granules for sorghum, left, corn, center, and wheat, right.

Present knowledge indicates that the gluten proteins of corn, wheat, and sorghum are quite similar chemically; however, the physical properties of wheat gluten differ greatly from those of corn and sorghum glutens. Wheat gluten exhibits unique hydration, extensibility, and elasticity that are the basis for the high value of wheat flour to the baking industry. These unique properties offer opportunities for specific industrial applications of wheat proteins, composed mainly of gluten. To date, no such large specialty applications have been found outside the food field. The high acceptability of wheat gluten in foods, especially at a time when special attention is being given to more protein in the diet, should be exploited—perhaps in new convenience, ready-to-eat foods that are so popular; thus, an increased outlet would be found in a high-value market. Another possibility is the development of new industrial products from flour taking advantage of the inherent properties of gluten to impart special qualities important to industrial applications.

When considering the opportunities for industrial outlets of wheat, compare it with some of the major, basic raw materials used by industry, their volumes, and prices (Table III). For wheat to have promise, it must be sufficiently cheaper than the end product to provide a substantial margin for processing. Fibers and rubber, because of their high dollar value, are attractive markets to seek. High-strength plastics for light-duty applications might move into some markets held by aluminum, copper, lead, tin, and zinc; the total market for these materials amounts to 5.5 million tons.

Wheat, including alcohol from

(Turn to UTILIZATION, page 4a)



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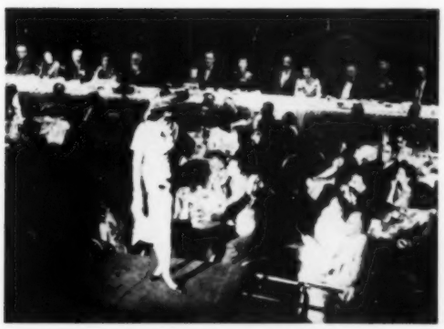
AOM Conference and Trade Show Picture Memories

The Association of Operative Millers recently held its 63rd annual technical conference and trade show at Chicago. Attendance numbered 750 technologists and their ladies. While this is not a record for the conference, it is possible that more than 1,000 people were on hand at various times during the sessions since the Millers National Federation and the American Feed Manufacturers Assn. were also meeting in Chicago during the week the AOM conference was held.

Warren S. Sentman, Miner-Hillard Milling Co., Wilkes-Barre, Pa., left, listens to an explanation about Allis-Chalmers Mfg. Co. equipment from Herbert Vanderlip.

Nurmi Winburn, Kansas City, shows a sprayer designed to spray back of boxcar linings at the Industrial Fumigant Co. booth.



A fashion show featuring styles created from cotton flour and feed sacks was a feature of the banquet. The fashions were prepared by the National Cotton Council.

Dow Chemical Co. literature is shown by Donald Surgeon, St. Louis, left, to J. O. Hibbard, Research Products Co., Salina.

Pictured, left to right, at the conference banquet are Mr. and Mrs. W. Francis Rowe, the Pillsbury Co., Minneapolis, and Mr. and Mrs. John T. Landes, Weber Flour Mills Co., Salina, Kansas. Mr. Landes and Mrs. Rowe are brother and sister.

Pausing for refreshments at the Sterwin Chemicals Inc., booth, are Mrs. John Wingfield, center, and Mrs. L. C. Robinson. Their husbands are with the Colorado Milling & Elevator Co., Denver. Serving the beverages is Thane J. Olsby, who is with Sterwin at Kansas City.

Ferguson Fumigants, Inc., products were exhibited by Roger Griggs, St. Louis, left, and L. E. McQuillen, Ferguson, Mo.

Gathered around a sonic valve at the Simon-Carter Co. exhibit, left to right, are Dan Strachan, Simon-Carter, Minneapolis; Paul Uhlmann, Jr., vice president of the Standard Milling Co., Kansas City, and Eric Stanger, Simon-Carter, Minneapolis.

Information on Keystone Lubricating Co. products was provided by William Pastryk, left, Chicago, and O. H. Jacobsmeyer, Jr., St. Louis.

Conversing are H. S. Sayre, the Fuller Co., Catasauqua, Pa., and O. J. Zimmerman, Smico, Minneapolis.

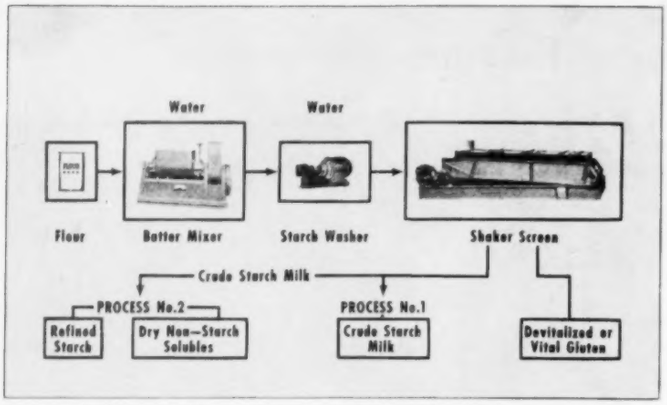


FIG. 2. Continuous batter process for wet-processing wheat flour into starch and gluten.

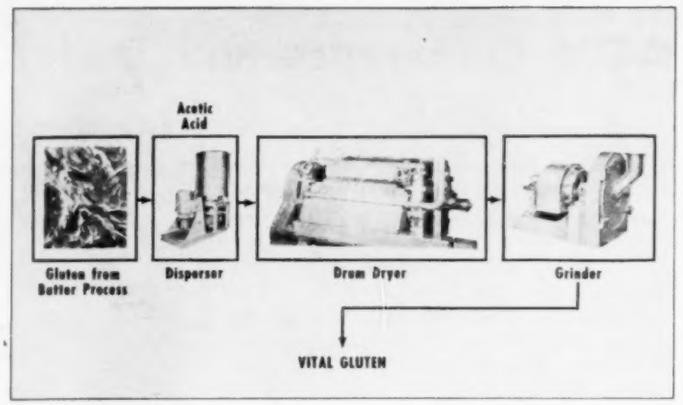


FIG. 3. Improved process for the production of gum gluten.

UTILIZATION

(Continued from page 1a)

wheat for motor fuel, obviously cannot compete economically in a direct fuel market with petroleum, coal, or natural gas even if it contained as much energy per ton. Also, breaking down the polymeric constituents of wheat to low-molecular-weight compounds so as to make them competitive with those obtained from natural gas and petroleum would be questionable.

It may be economically feasible to convert grain into specialty structural materials, such as insulating board and formed board products. Here the margin between grain prices and end-product prices would be borderline if much processing is required. For wheat to have advantages over other grains in such a development, special properties of the gluten would have to be exploited.

The large and expanding markets for paper and paper products offer a promising avenue for increasing industrial uses of wheat. The potential suitability of wheat constituents for use in the paper industry is evident from knowledge of the chemical and physical nature of starch and gluten and from the fact that nearly a billion pounds of starch is already used in papermaking each year. Here again flour or other dry-milled fractions are the most promising raw materials from wheat. The consumption of paper and paper products is expected to increase from 34 million tons in 1955 to 56 million in 1975; proportionate increases in the use of cereal products would make an important market; further advantages would be gained if the percentage of cereal components in paper could be increased from the current 1% to the order of 5%.

Raw materials for some of the 15 billion pounds of organically derived end-products produced by the rapidly growing chemical industry offer additional outlets for cereal products. In recent years, agricultural materials have been "researched" out of much of this market—for example, synthetic detergents have displaced soap, synthetic glycerine has displaced glycerine from animal fat, and alcohols and acetone once obtained by fermentation of sugar and grain are now produced from petroleum.

Current Outlook

Research directed toward industrial utilization of wheat has received increased emphasis by government and industry in the past few years. Because primary attention in the past has been given to the use of wheat in bread and related food products, there is a paucity of basic information on which to pursue an applications research program. After decades of research on wheat, one might wonder what opportunity remains for further advance. Yet can anyone say that it is not possible to find sufficiently high-value outlets, either food or industrial, for wheat gluten to allow competition of wheat starch with other cereal starches? Can we say that the specific properties of wheat starch have been exploited to the fullest? Have milling processes reached the ultimate for furnishing components and milling fractions as raw materials for industrial use? Is it impracticable to convert flour, containing both starch and protein, by chemical modification to products having unique properties suitable for industrial applications? The research program at Peoria is designed to answer these questions. At present this program is largely of a fundamental and exploratory nature to provide the necessary leads for future applied research. Applied and developmental research is, however, underway in a number of use areas.

TABLE III. MAJOR BASIC INDUSTRIAL RAW MATERIALS
[1957 Production or Imports for Use]

Item	Million tons	Value per ton
		Dollars
Fibers (all types)	5.0	1,070
Rubber (all types)	1.0	960
Aluminum, copper, lead, zinc, tin	5.5	410
Crude petroleum	550.0	20
Natural gas	225.0	4
Coal	500.0	10
Gypsum	15.0	15
Wood pulp	50.0	155
Lumber	55.0	109
Wheat	1/	60

1/ Twelve million tons produced in excess of needs in 1958.

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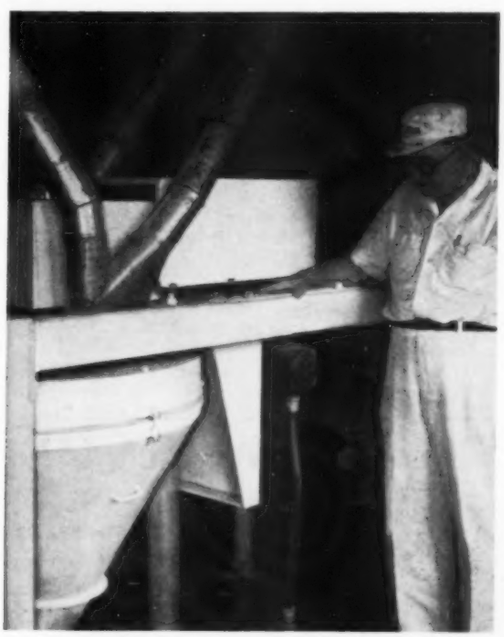

Pictured above is one of the new 27" Entoleter Centrifugal Impact Mills recently installed at Dixie-Portland. Mr. Cobble, Milling Superintendent, checks one of the new units which requires only 14.8 sq. ft. of floor space.

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utilization research is to obtain selected constituents or grain fractions that, on the basis of their specific properties, can be used as such or converted into products for industrial outlets. Two recent developments toward achieving this objective are: (1) The continuous batter process developed by the Northern Division for wet-processing flour and (2) the fine grinding of flour followed by separation into fractions of unique composition and physical properties developed by industry.

The continuous batter process (Fig. 2) is being studied by industry; it offers promise of economies for wet-processing flour, especially second clears. In this process, flour is mixed with 1 to 1.5 parts of water to form a batter or thin dough from which the starch is washed out and the gluten separated on a shaker screen. Starch is recovered by tabling or centrifuging the starch milk. Gum gluten is recovered by dissolving the wet gluten in dilute acetic acid at pH 4.5 and drum-drying (Fig. 3). From 100 lb. flour, about 14 lb. gluten (80% protein), 76 lb. starch and 10 lb. nonstarch solubles are recovered.

To implement future studies on the use of dry-milled products, particularly fractions of unique chemical composition, a pilot plant comprised of a full complement of wheat dry-milling and processing equipment, including facilities for conditioning, roller milling, fine grinding, physical separation, and particle-size analysis, is being designed and installed at Peoria. Our objective is to establish operating conditions for producing wheat fractions of potential industrial use, to obtain cost data, and to provide working quantities of products for evaluation of applications as industrial raw materials. Fractions having potential utility will be investigated for use as chemically modified products, and for use in fermentative conversion to industrial products and feed supplements. Wheat offers advantages over other cereal grains in dry-milling practices because flour fractions not particularly suited for industrial use may find outlets in higher-value food products.

Unmodified Flour Hydroxyethylated Flour

FIG. 4. Flow characteristics of flour pastes, before and after reacting with ethylene oxide: Solids concentration in both samples, 7% by weight; flour in sample on the left contains 6% by weight of hydroxyethyl groups.

Our dry-milling investigations will be supported by fundamental studies on conditioning and tempering prior to milling. A better understanding of wheat conditioning and the changes occurring during this process is basic to the development of improved milling operations and new milling products. Although it is well established that conditioning lowers power consumption and increases flour yields, the operation is yet to be put on a sound scientific basis; there is need for a test to determine when wheat is in optimal condition for milling, and basic information is needed on the effect of moisture on cell layers.

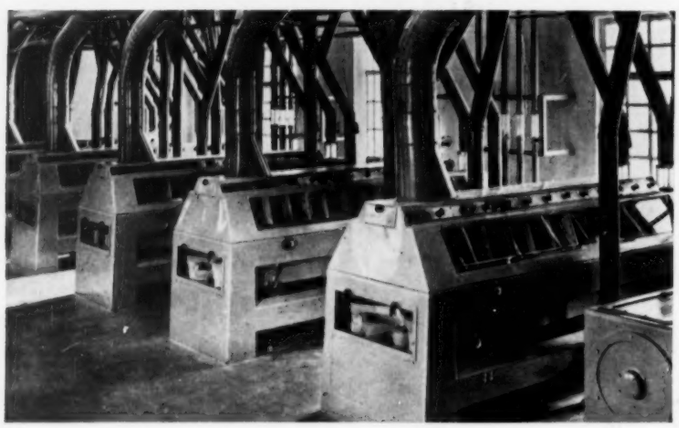
The first phase of this work, initiated at the request of the Association of Operative Millers, consists of an extensive literature survey on tempering and conditioning of wheat. Particular emphasis was given to reports of work in Europe where much of this research has been done in the past 25 years. Over 400 articles in the foreign literature not previously abstracted in English were translated. A summary of existing factual information is in the process of being published.

The second phase consists of laboratory studies on the development of methods for measuring the distribution of water within the cellular matrix of the wheat kernel as affected by conditioning treatment. At present, emphasis is on methods for determining the penetration and concentration of water in the kernel tissues by such techniques as interference microscopy, radioactive water, and staining techniques. When suitable methods are established, the distribution of moisture in cell layers will be determined and results will be correlated with milling characteristics. Results to date indicate that water first enters around the germ, then at the brush end of the kernel, and finally from all sides. The aid and cooperation which we have and are receiving from members of AOM and from the Millers National Federation have made this study on conditioning possible and meaningful.

Another research project concerns the milling quality of soft wheats. This work is being done under contract at Ohio State University Research Foundation by Dr. R. A. Popham. He is correlating the microscopic structure and compositional differences of soft red winter wheat varieties with milling performance and flour quality. The possibility of developing a simple test based on compression strength of kernels and staining techniques to determine milling quality of different varieties and samples without going through milling procedures offers promise.

Advances in milling, the development of new processes, and exploration of new milling products are not only important for the development of expanded outlets, but also contribute much to the maintenance of existing outlets in a competitive market economy.

Chemical Modification of Flour. Wheat flour represents an intermedi-



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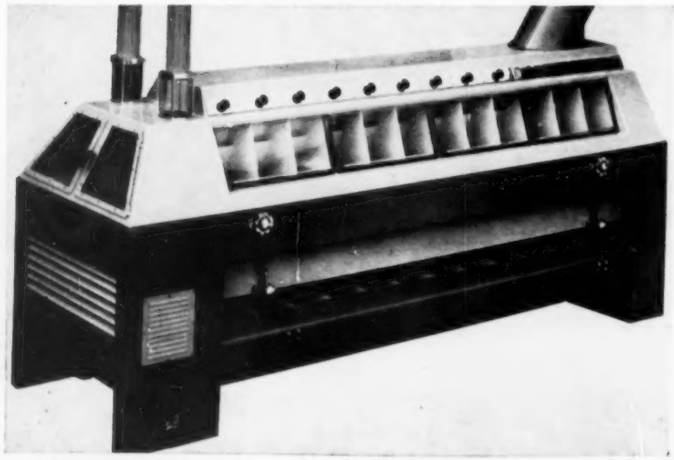

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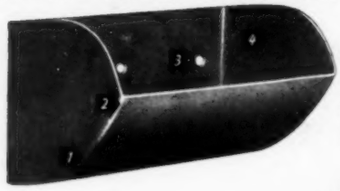

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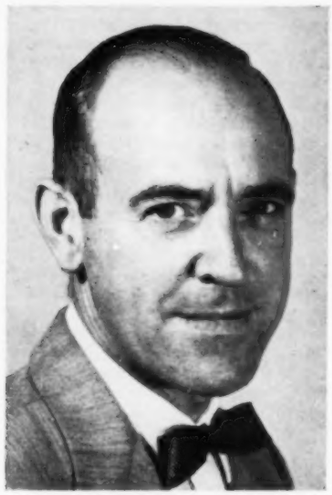

Dr. F. R. Senti

ate stage of refinement of the grain into chemical constituents. It is usually available at a lower cost than either of its principal constituents—starch and gluten. The new milling techniques of fine grinding and physical separation of fractions offer promise of a wider variety of flour fractions for possible industrial applications. Flour offers a further advantage in the possibility of utilizing the unique properties of its gluten to modify its starch properties, thus creating new products for industrial use. To exploit this field, research is underway to explore the chemical modification of flour.

Chemical reactions to effect a desired modification can be utilized to produce a product with valuable properties, but too often the chemical conversion process is so expensive as to price it out of the market. An important phase of research in this area is the development of new and more economical conversion processes. Our chemists have developed an economical process for reacting flour with a number of chemical reagents in essentially a dry state. The reaction of wheat flour with ethylene oxide to produce hydroxyethylated flour is the first to be studied. This chemically modified flour has promising characteristics. Its pastes exhibit a high degree of clarity, whereas unmodified flour gives opaque ones. Of particular interest are the modified viscosity characteristics of pastes made from hydroxyethylated flour and their improved flow characteristics (Fig. 4). Both degree of clarity and viscosity can be controlled by the extent of ethylene oxide reacted. Aging tests have shown that the derivative is stable.

Another derivative under study is the reaction product of propylene oxide to give hydroxypropylated flour, that exhibits properties somewhat different from those obtained with ethylene oxide. The reaction product from acrylonitrile also appears interesting. Considerable fundamental research is required before these chemical derivatives can be properly evaluated. To control the reactions, hence the properties, the extent and nature of the reaction with the various flour components must be determined. The reaction with dextrinized flour gives products of still different properties and must be investigated. Cross-linking reactions and further chemical modification of the derivatives remain to be studied. It is readily seen that a whole family of new products is possible, all of which must be studied from a fundamental standpoint and evaluated for possible applications. The potential range of new products is further expanded as a result of new milling fractions, such as high starch and low protein fractions from new milling processes, that are becoming available for study. Investigations of these new fractions will be coordinated with dry-milling studies now being initiated.

Starch Investigations. The major constituent of wheat, as in all cereal grains, is starch. It follows that utility of cereals as a raw material must

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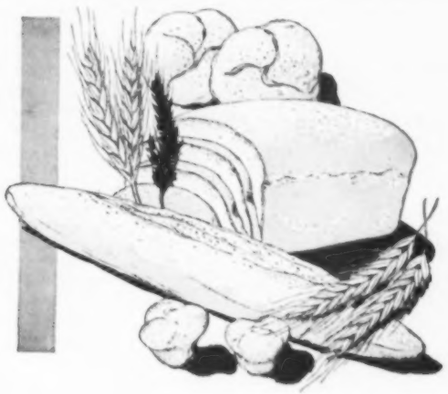
FLOUR FOR MAN'S BREAD*



A Brief History of Milling and Baking by SCIENCE WRITER

CHAPTER XXIV *Today's Milling, White Flour, and White Bread*

Through The Mazes of Modern Milling

The picture of the old grist mill by a stream, its wheel slowly turning, the water purling and splashing in the outflow, is a charming and romantic one. Such mills, however, could supply only the smallest fraction of our present flour needs.

In a society and economy which cover a continent we must have large units capable of mass production. Today's flour mills fit this requirement.

Let's take a quick trip through a modern flour mill. From the storage elevators the wheat goes through a cleaning cycle which can include five separate dusting operations. It is passed over two sets of magnets for removal of tramp iron. It may be heated and tempered, or washed and dried.

Then the grain is ground. It may pass through as many as five sets of rollers. After each grinding it is sifted. It is graded and dusted. Flowing along through a complexity of chutes, machines, conveyors, and elevators, the white flour passes the point at which it is carefully enriched with vitamins and iron on its way to packaging. Only about 15 minutes elapse between the time the grain enters the rollers until the finished flour reaches the packing room.

The First Business of Millers

Millers' major customers are bakers. Home baking (using mixes or family white flour), breakfast foods, crackers and cookies, macaroni products, pet foods, and animal feeds also use large amounts of the mills' output.

The first business of millers, however, is making high grade white flour to suit the particular formulas of commercial bakers. Using ingenious applications of engineering techniques and research findings, the millers produce standardized products which meet the exacting requirements of their customers for fine, white, nutritionally valuable, quality flour with known baking characteristics, flour that is universally available at reasonable prices. No small achievement, that.

How To Satisfy The Public Taste

Most bread consumed in the United States today is commercially baked. It is pure, nutritious, long-keeping, with many varieties to satisfy the public taste. Daily the bakery trucks roll through the cities and across the countryside so that even remote stores at the farthest crossroads have good, fresh white bread for their customers.

White is the preferred color for our bread. That is what we want by a large margin. In some countries such bread is considered a luxury, equal to cake. In the United States it occupies the position of a staple in our diet.

Why Enrich?

Adding pure, low cost vitamins to family white flour and white bread has been a widespread practice for many years. This is known as *enrichment*. Vitamin B_1 (thiamine), vitamin B_2 (riboflavin), niacin (another "B" vitamin), and iron are added to the food during processing to replace those vital elements which are lost, unavoidably, when wheatberries are ground into white flour. Calcium, too, may be included in the enriching mixture.

Why is the loss of natural vitamins "unavoidable"? The answer lies in the key word—*white*. To give us the white foods we demand, millers *must* remove fractions of the wheat which contain some, but not all, of the wheatberry's natural vitamin and mineral values. Very sensibly, the *enrichment* ingredients are added by the millers or bakers to give us the white foods we want and the vitamins B_1, B_2, niacin and iron which our bodies need.

Help For You

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The next chapter in this series, titled: "Enrichment Up-To-Date" will be published soon.

* Based on the book with the same title by John Storck and Walter Dorwin Teague, this series has been made possible through the cooperation of the copyright holder, the University of Minnesota.

Enriched with vitamins and iron for better nutrition

depend in large measure on the properties of starch, either as the separated component or as it exists in various milling fractions. Many industrial uses already exist for starch. Indeed, it ranks as one of the most widely used organic high polymers; approximately 1.5 billion pounds are used industrially each year.

A promising new starch derivative currently receiving attention is dialdehyde starch produced by periodate oxidation, a reaction used for many years as an analytical tool. It has remained a laboratory curiosity because of the high cost of periodate ($28 lb.). Our contribution is the development of an electrolytic process whereby oxidation is carried out with a small amount of periodate which is continually regenerated in an electrolytic cell. Four companies have been licensed to operate under our public service patents, and two have built pilot plants patterned after ones developed by our chemical engineers. Over 3 000 lb. have been prepared in our pilot plant and furnished to 40 individual concerns for evaluation studies. Indicated uses to date are for making wet-strength paper, oil well drilling mud additives, leather-tanning agents, and coatings.

Treatment of dialdehyde starch with chlorous acid yields dicarboxyl starch—a new nongelling starch derivative. Since our announcement of this development last September, 100 samples have been distributed to 40 different companies for performance studies in the manufacture of papers, paints, textiles, drilling-muds, toiletries, cosmetics, and food products.

Research is progressing on methods for preparing chemicals from dialdehyde starch for use in resins, plastics, and similar products.

Future developments for starch utilization must come from basic and exploratory studies aimed at finding important, new principles to open new frontiers. Accordingly, projects are underway to explore new chemical reactions and transformations of starch, dextrins, and glucose. Basic studies directed toward elucidating the molecular structure and physical properties of starch and its derivatives are part of our program.

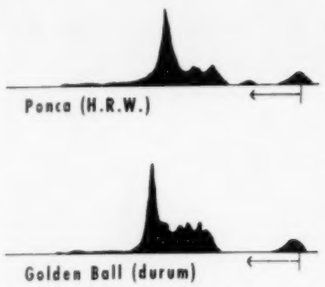

FIG. 5. Electrophoretic patterns showing differences between glutens from two wheat varieties.

Research on Wheat Gluten. As previously stated, the industrial utilization of greater quantities of wheat depends in part on exploiting the unique properties of gluten for relatively high-value outlets. To accomplish this objective, more basic information on these proteins is required. Despite the years of study already devoted to it, wheat gluten still remains a mystery in terms of modern protein chemistry.

A recent breakthrough in the study of these proteins allows, for the first time, separation of the gluten into its protein components. Instead of the classical separation into gliadin and glutenin, we have separated gluten into several different proteins. The numbers and amounts of different protein components appear to be different in some of the glutens we have examined. Fig. 5 shows the electrophoretic patterns of glutens from Ponca hard red winter and Golden Ball durum wheats. The pattern for Ponca gluten shows five peaks, i.e., five protein components, while that for Golden Ball shows six peaks. The significance of these differences will have to await further studies on the separated protein components. The way is now open for learning why wheat gluten differs from the gluten of other cereal grains, and also how glutens from different wheat varieties differ. Fundamental studies are underway to determine the chemical and molecular properties of the separated proteins, and to explore their chemical reactions and modifications. These studies are designed to provide avenues for modifying the properties of gluten to make it better adapted to a maximum range of industrial uses. Already we have evidence that the unique property of gluten to form a coherent elastic mass, so important in breadmaking, is associated with only one of the five proteins isolated from Ponca wheat gluten. Continued emphasis on these gluten studies offers the best hope for revealing new high-value outlets so important for expanded use of wheat by industry.

Fermentative Utilization. Cereal substrates for fermentative processes are largely derived from the cheaper feed grains. Fundamental and exploratory studies have recently been initiated to determine whether wheat has specific properties that could be exploited for use as a substrate. Microorganisms and fermentation processes requiring wheat as a substrate are being examined for the production of new polymers. If this approach to use wheat to produce microbial polymers at a reasonable price is successful, applied research will be undertaken to evaluate the processes and polymers.

Another approach is the exploration of procedures to produce the enzyme known as deamidase. If this enzyme can be made by practical methods, it can be used to hydrolyze the amide groups of gluten to give a new water-soluble product.

Conclusions

We have seen that the industrial uses of wheat amount to only ½% of the crop; in spite of its higher price as compared to feed grains certain uses based on specific properties of wheat persist. Opportunities for future use lie in elucidating these specific properties through fundamental and exploratory research, and in exploiting such specific properties for industrial outlets. The problems for basic and applied research involve,

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first, extending our basic knowledge of the principal components—starch and protein—second, devising the most economical methods for producing the desired components or milling fractions, and third, search for end uses through modification or conversion to new products.

The most promising potential for outlets of wheat as industrial raw materials lies in taking advantage of the polymeric character of starch and gluten and the complexity that nature has built into these constituents. The development of dialdehyde starch to give a new polymer too complex for ready chemical synthesis is an example of this approach.

What is needed are new concepts and new ideas not known today to provide the basis for the development of new products, new processes, and new uses. These new concepts and new ideas can come through fundamental and exploratory research. When they will come, or whether they will even come from fundamental research on wheat, cannot be predicted. Fundamental principles discovered through basic research can be applied by scientists everywhere, now and in the future; in contrast new products and new processes, like old soldiers, may fade away and be replaced by better ones stemming from new information provided by fundamental research.

The AOM and MNF have played an active role in the research program directed toward increased wheat utilization. In addition, state wheat commissions and grower organizations have participated not only in the development of a government research program but in developing their own programs to do a job on wheat surpluses. Congress has not been unmindful of the need for more emphasis on utilization research as evidenced by increased appropriations over the past few years, and the introduction of some 50 bills proposing an expanded program on utilization research since the President's Commission on Increased Industrial Use of Agricultural Products reported its recommendations in June, 1957.

Dr. Stanley N. Ward William Burr

APPOINTMENTS — Two staff appointments have been announced by PCO Services, Ltd., of Toronto. W. Brennan, president, has announced the appointment of Dr. Stanley N. Ward as head of the firm's new sanitation consulting division. Dr. Ward is a graduate of the Ontario Veterinary College with postgraduate training at the University of Toronto. Dr. Ward has been very prominent in the field of public health during the past 10 years. Prior to joining PCO, he was assistant director of food control and sanitation for the city of Toronto. E. G. Edinger, general service manager, announced that William Burr, who has been specializing in milling pest control for the past five years, has joined the milling pest control division. Mr. Burr's father has been a miller all his life, and Mr. Burr has worked in the milling business for 23 years. Prior to joining PCO, he was assistant milling superintendent for S. J. Cherry & Sons, Ltd., at Preston, Ont.

Winners in Contests At AOM Conference

CHICAGO—Winners in the "wheel of fortune" contest conducted by the Simon-Carter Co., Minneapolis, and the "number game" conducted by Kwal Paints, Inc., Denver, at the recent Association of Operative Millers technical conference and trade show at Chicago have been announced. Here is a list of the Simon-Carter winners:

Monday a.m.—Donald S. Eber, AOM executive vice president, electric clock.

Monday p.m.—Edward F. Seeborg, Foreign Agricultural Service, silver well and tree platter.

Tuesday a.m.—Harold J. Goossens, Russell-Miller Milling Co., Minneapolis, electric knife sharpener.

Tuesday p.m.—J. E. Anderson, Igleheart Bros., General Foods Corp., Evansville, Ind., fitted picnic basket.

Wednesday a.m.—Mel Shol, Hubbard Milling Co., Mankato, Minn., barometer and thermometer set.

Wednesday p.m.—Mrs. Charles Barshinger, Red Lion (Pa.) Milling Co., Faribo Pak A Robe. Charles Dowd, International Milling Co., Minneapolis, game set.

The grand prize given at the banquet was an electric liquid blender won by Mrs. J. E. Burns of J. R. Short Milling Co., Toronto, Ont.

Here is a list of the winners in the Kwal contest:

Mrs. Margaret Landes, Salina, Kansas; C. E. Danielson, McPherson, Kansas; Warren Watt, Hammond, Ind.; Mrs. D. McAllaster, Denver; Mrs. Roger Pratt, Wallace & Tiernan Inc., Kansas City; Paul McSpadden, Minneapolis; E. J. Gehrig, Quaker Oats Co., Chicago; Mrs. Robert Hill, Rolfes Aeration Cos., Boone, Iowa; Gladys Thompson, Spangler Milling Co., Camp Hill, Pa.; H. Irvin Spratt, Whitewater Flour Mills Co., Whitewater, Kansas; Mrs. Della Eber, Kansas City; K. E. Rosene, GATX, Chicago;

Arline M. Lilly, Quaker Oats Co., Barrington, Ill.; O. H. Jacobsmeyer, Jr., Keystone Lubricating Co., St. Louis; Lorrain Maas, Screw Conveyor Corp., Hammond, Ind.; Ellis P. Maas, Screw Conveyor Corp., Hammond, Ind.; Tom Cook, Cook & Cook, Dallas; Grace McQuillen, Ferguson Fumigants, Inc., Ferguson, Mo.; Mrs. Edith McKay, Flossmoor, Ill.; Marie Randall, Sterling, Kansas; C. C. Rexrode, Kansas City; Mrs. Deanne Cook, Dallas.

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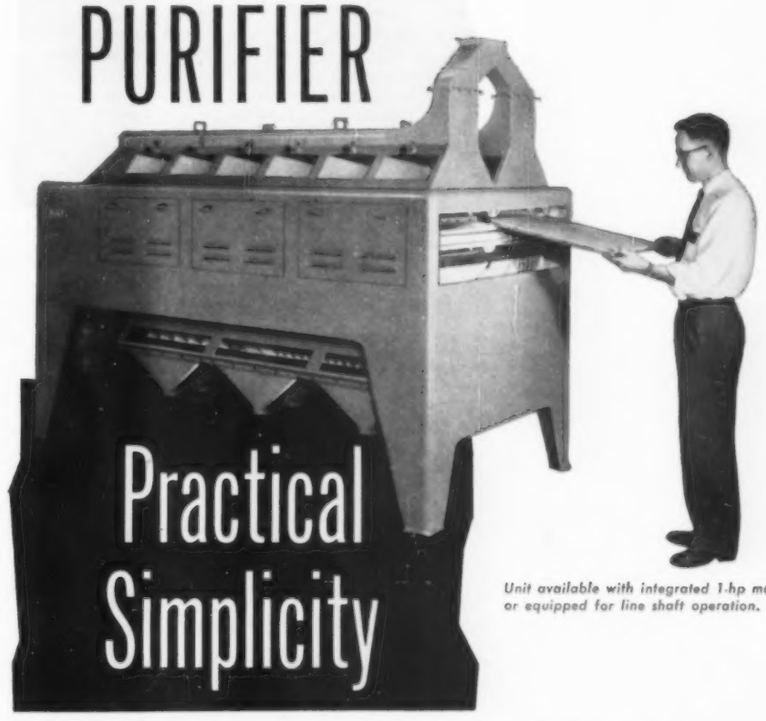

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Millers' Sons Found Great Businesses

By John Speight

FLOUR milling, one of the oldest occupations in the world, ranking second in importance to agriculture, can be considered a great asset to any nation. During the long period the milling business has been in operation there have been many millers who, from time to time, have occupied positions of national importance, in addition to caring for their own businesses. In direct contrast to this, many of its illustrious sons, who by breaking away from the age-old tradition of following in father's footsteps, have entered into new walks of life in which they have achieved considerable success, accompanied by worldwide fame.

In this connection I recently came across a copy of an old document of interest to millers, which dealt with the question of sacks used in the milling business. It clearly shows that the question of sacks and sack hire is by no means new. Evidently this matter of sacks has plagued the British milling industry for generations past as this document, dated 1792, proves. The document reads as follows:

Sack Protection Agreement

Articles of agreement indented and made covenanted concluded and fully agreed upon this second day of April in the year of our Lord One Thousand Seven Hundred and Ninety Two.

Whereas We whose names are hereunter subscribed and seals affixed being resident within the Wapontake of Strafforth and Tickhill in the West Riding of the County of York and using and exercising the trade or occupation of Millers and having for a long time past found from experience and practice that WE have sustained and incurred considerable loss and damage and expense in finding and furnishing sacks and bags for the accommodation and convenience of the several persons who have and now do grind corn at our several and respective mills and in order to prevent our sustaining any loss or damage in future respecting the same have now come to the following mutual and reciprocal resolutions and agreements with and amongst each other.

NOW THOSE PRESENT WITNESS That we whose names are hereunter subscribed and seals affixed and every one of us Do Covenant promise and agree to and with each other and for our and each of our Executors Administrators and Assigns in the manner following, that is to say:

FIRST That if any of us or any of our Executors Administrators or Assigns shall from henceforth at any time or times hereafter furnish or find and provide sacks or bags for any person or persons whosoever he or she or they may be and for whom any of us or any of our Executors Administrators or Assigns shall grind corn for at our several mills (save and except for corn flour or meal or any article our own property and to be sold by us or any of us or any of our Executors Administrators or Assigns to our several and respective customers).

That then and in such case such of us or our Executors Administrators or Assigns so furnishing finding or providing sacks or bags as aforesaid shall forfeit and pay to the other of us and our Executors Administrators or Assigns the sum of ten shillings for each and every such sack or bag so to be found and provided as aforesaid and which the said sum of ten shillings shall be obtained and recovered with costs either by action at Law or by information before some one of His Majesty's Justice of the Peace for the West Riding of the County of York at the option of a majority of us or any five of us or our Executors Administrators or Assigns and which the said sum of ten shillings shall be applied and disposed of in the manner following, that is to say two shillings and sixpence part thereof to the person giving such information to us or any of us or to our attorney, but not to be paid until conviction of the party so offending the remaining part thereof to be applied towards carrying on prosecutions against any of us or our Executors Administrators or Assigns acting contrary to the aforesaid resolutions and for such other purpose as a majority of us or our Executors Administrators or Assigns subscribing hereto shall in our and their discretion think proper and that all such suits and prosecutions shall be instituted and carried on by and with the consent of a majority of us, our Executors Administrators or Assigns subscribing hereto or any five of us or our Executors Administrators or Assigns AND it is hereby further agreed by us or our Executors Administrators or Assigns shall keep and detain in their custody or possession or make use of in our or their said several and respective trades and occupations any sack or bag belonging to any other of us or our Executors Administrators or Assigns then and in such case we do hereby covenant promise and agree to pay to the other of us, our Executors Administrators or Assigns the sum of ten shillings for each and every sack or bag that shall be so retained by us or our Executors Administrators or Assigns in our and their possession or made use of by us or them as aforesaid not being our or their own several respective properties.

AND it is further agreed by us that these presents shall take effect from the day of the date hereof and continue in force for and during the term of twenty-one years from thence next ensuing subject nevertheless to an end or determination thereof by a majority of us at any time during that period subscribing our names to a written instrument at a meeting of us, our Executors Administrators or Assigns to be called for that purpose for the rescinding thereof that then and in such case these presents shall be null and void and of no effect as if the same had not been made and lastly for the due performance of all and every one of the several articles covenants conditions and agreements aforesaid we whose names are hereunter set and subscribed and seals affixed do hereby bind and oblige ourselves each to the other and our Executors Administrators or Assigns each to the other in the penal sum of One Hundred Pounds of lawful British money firmly by these presents IN WITNESS whereof we whose hands and seals the day and year first herein before mentioned.

Signed

Robert Taylor (S) Joshua Wigfull (S)
John Taylor (S) John Vickers (S)
James Taylor (S) William Barton (S)
Richard Wilson (S)

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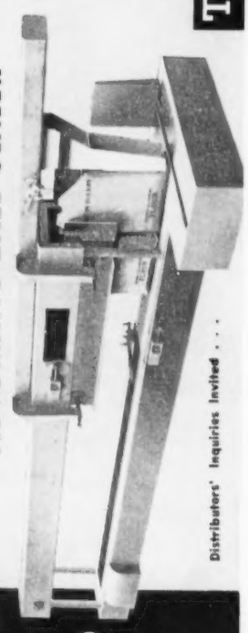

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customers whose corn they ground, and who apparently were not very particular about returning the empty sacks. In making this document they agreed not to lend sacks in future; failure to observe looked like being a somewhat costly affair in those days.

The most interesting thing about this document is the signatories to the agreement, one of which is that of John Vickers, who apparently owned a small water mill situated on a branch of the River Don, which flows through the center of the city. Apparently a mill has stood on this same site from the time a nobleman, named De Lovetot, Lord of Sheffield manor, erected a mill in the 12th century for the purpose of supplying meal for the inhabitants of his castle.

Very little is known of the history of this mill since that time until the early part of the 18th century, when it came into the possession of a man named Foord, who in 1756 sold the mill and land belonging to it to John Vickers.

The area in which the mill stood was and is known today as Millsands. The mill remained in the possession of the Vickers family until the year 1849, when it passed into the hands of the Price family who had been in the milling business for many generations past in another part of the district. Under their management the mill was enlarged and became known as the Town Mills. Later the name was changed to the City Mills, which eventually became absorbed into the Rank organization about 1930, when it was dismantled and closed down. In the mill yard up to the time the business was sold there stood a large rambling old house, built many generations previously, where John Vickers lived with his large family of boys, and where his son Edward was born. The latter was mainly responsible for the great Vickers organization coming into existence.

With only a small water mill containing about four pairs of millstones, John Vickers found it extremely difficult to provide a living for his large family, naturally it became a bit of a problem to him. It was obvious the mill could not support them all, so he began to look elsewhere for suitable openings for his sons.

Beginning of Empire

On the opposite side of the road in Millsands was a small iron works owned by one Jonathan Marshall, who naturally was very friendly with John Vickers whose son, Edward, when he was about 25 years of age married Anne Naylor, daughter of George Naylor, who was a partner in a small iron works in Sheffield.

In 1829 Mr. Naylor entered into an agreement with a man named Mr. Hutchinson and William Vickers, another son of John Vickers, who was no doubt acting in the matter for his father, to purchase the iron works from Mr. Marshall. No doubt it was the intention of Mr. Naylor and John Vickers, parents of the young couple, to acquire these works in order eventually to provide a living for them.

In due course Mr. Naylor made Edward Vickers a partner in the business, which was a lucky thing for him, otherwise there would in all probability have been no Vickers works, etc.

The mill of John Vickers being in close proximity to the iron works now owned by the firm of Naylor, Hutchinson and Vickers, he naturally took an active interest in the concern, having no doubt invested quite a sum of money in the business. In time the partner, Mr. Hutchinson, ceased to have any interest in the firm, which then became known as Naylor & Vickers, who later on, with a small amount of capital at their disposal, launched out and started the Don Iron Works adjoining the mill in Millsands. In time Mr. Naylor retired from the business and the concern became known simply as Vickers, Ltd.

Edward Vickers, head of the firm, also had several sons, one of whom, Thomas Edward, who was born in the mill house in 1833 and died in 1915, spent the whole of his life in the Vickers concern, becoming managing director of this great works at the turn of the century. It was in this way that a miller's son founded what was to become known as one of the greatest names in the world of engineering, as builders of battleships, airplanes, armaments, atom power plants, etc., which organization today has a combined capital of some $448 million. Truly the world is greatly indebted to the milling profession for much of the progress that has been attained in this manner.

Richardson Formation

In this connection one cannot help adding yet another illustrious name to the list by mentioning Henry Richardson, son of James Richardson, who at one time owned the City Mills, Litchfield, Staffs. Henry Richardson, one of a large family of boys, was of a mechanical turn of mind, with the result he invented a type of automatic grain scale which largely helped to revolutionize the weighing of grain in bulk. He did this mainly in order to relieve himself of the somewhat arduous task of weighing grain by hand at his father's mill. He was granted a patent No. 457, in January, 1890, other patents in connection with his scale following as a matter of course.

(Turn to SONS, page 17a)

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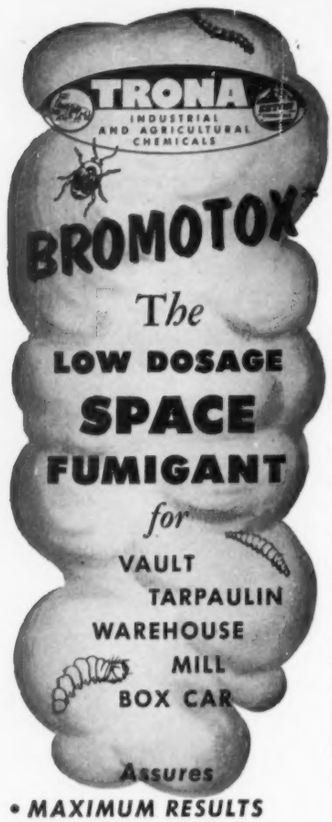

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List of Needed Equipment For K-State Milling Facilities

FOLLOWING is a list of needed equipment as approved by the equipment committee for rebuilding the flour milling facilities of the department of flour and feed milling industries at Kansas State University, Manhattan. These facilities were destroyed by fire Aug. 25, 1957. The list is taken from a prospectus covering the history, research and educational accomplishments together with present plans for the department. The prospectus was prepared by K-State for the Millers National Federation committee that is working with K-State in the rebuilding program. John J. Vanier, Weber Flour Mills Co., Salina, Kansas, chairman of the MNF committee, presented a comprehensive report on the K-State plans at the recent federation convention at Chicago.

SUMMARY

Cleaning House Equipment & Installation	$116,583.50
Flour Mill Equipment & Installation	168,750.00
Unit Operations Equipment & Installation	25,400.00
Student Experimental Milling & Research Labs Equipment & Installation	82,200.00
	$392,933.50

ITEMIZED LIST
Cleaning House

Equipment Item	Estimated Cost
C-1 15' addition to present 9" screw conveyor in Feed Tech. with 2 curved slide gates and discharge spouts	$ 300.00
C-2 1—6" Dracon Conv. 35' long with drive, supports, 8 curved slide gates & discharge connections	1,500.00
C-3 8—2-way 6" valves	375.00
C-4 14—steel storage bins, 54" dia. x 29' high with antigrading hoppers and slide gates	8,000.00
C-5 2—100 bu. mill mix bins with antigrading hoppers and slide gates	450.00
C-6 14 assorted types volumetric feeders 5—50 bu./hr. ea.	5,000.00
C-7 1—6" Dracon reversible conveyor, 30' long with drive & supports	1,200.00
C-8 1—200 bu./hr. bucket elev., 45' c-c with variable speed drive	1,200.00
C-9 1—1 bu. Richardson automatic scale with timed dump, hopper & self-regulating discharge feeder	1,400.00
C-10 5 pneumatic lifts, 60 bu./hr., 45' high including aspirators for each	10,000.00
C-11 1 magnet, alnico spout type	200.00
C-12 1 No. 4 Millerator with drive & dust collector	2,800.00
C-13 1 Dry stoner complete with suction hood, fan & cyclone dust collector	2,000.00
C-14 1 Cylinder Oats Separator	1,000.00
C-15 1 Carter disc combination oats & seed separator	2,700.00
C-16 2 Entoleter-Scourer-Aspirators, 1750 r.p.m.	3,400.00
C-17 1 250E American blower, 2000 cfm, 5" S.P., with 3 h.p. motor and drive	500.00
C-18 2 High efficiency cyclone dust collectors with air locks, 1000 cfm each	900.00
C-19 1 40-bu. bin	80.00
C-20 1 Merchen scale feeder, capacity, 10-100 bu./hr.	2,000.00
C-21 1 Wheat washer and whizzer	3,000.00
C-22 1 Vacuum conditioner	8,500.00
C-22 1 Radiator + cooler conditioner	8,500.00
C-23 1 Hot air + cooler conditioner	6,500.00
C-24 1 Steam conditioner with controls and regulators	2,500.00
C-25 2 10' long, 6" half pitch screw conveyors, 5 discharges, with slides and drive	1,000.00
C-26 8 2' dia. x 12' tall tempering bins with 60° hoppers, inner cone, 4" discharge hole	1,000.00
C-27 1 Wheat brush machine	1,700.00
C-28 1 3-way valve for elevator head	80.00
C-29 1 General suction system, duct work, fan motor and cyclone dust collector	1,700.00
C-30 1 Filter dust collector, 7000 cfm	6,000.00
C-31 1 Thickness Grader	1,000.00
C-32 500 ft. 4" pre-fab spouts, valves, hand holes, etc.	3,000.00
C-34 Electric motors not furnished with equipment	3,000.00
	$92,485.00
Mill wright labor	8,000.00
Electricians	5,500.00
Plumbers	4,500.00
	$105,985.00
+ 10% contingency	10,598.50
TOTAL	$116,583.50

Flour Mill

M-1 Atomizing dampener	950.00
M-2 4" screw conv., 10' long with drive	450.00
M-3 1—2' dia. x 6' high with 60° hopper and inner cone	150.00
M-4 1—1 bu. auto scale with timed dump, hopper and regulation of discharge rate	1,400.00
M-5 Entoleter and aspirator, 30 bu./hr. variable speed drive	2,750.00
M-6 800 cfm fan, motor and drive with cyclone dust collector	700.00
M-7 3—double stands, 9 x 15" roller mills with diagonal roll mounting and pneumatic connections to hoppers	12,000.00
M-8 2—single stands, 9 x 15 roller mills	1,700.00
M-9 6—single stands, 9 x 10 roller mills	5,100.00
M-10 4—single stands, 9 x 6 roller mills	3,400.00
M-11 2—line shafts to drive rolls, with bearings & pulleys	1,000.00
M-12 2—Pivoted bases for motors	300.00
M-13 2—15 h.p., 1725 r.p.m., Class II, Group 6, motors	1,500.00
M-14 Pneumatic elevation system, 30 lifts with cyclones, air locks & blower	15,000.00
M-15 1—filter dust collector, 2500 cfm	3,000.00
M-15 1—low pressure fan (2500 cfm) with motor & drive	700.00
M-16 5—2 x 14 frne swinging sifters	12,500.00
M-16 1—single section floor munted sifter, 8 sieves with drive	1,200.00
M-17 1—double purifier, double or triple deck, 8" wide sieves	3,000.00
M-18 2—double purifiers, double or triple deck 4" wide sieves	3,400.00
M-19 1—fan (2000 cfm) with motor & drive for purifier	700.00
M-20 6—cyclone dust collectors with air lock feeders & drive for purifiers	2,400.00
M-21 1—filter dust collector, 2500 cfm for purifiers.	3,000.00
M-22 2—flour stream samplers each consisting of 14 3-way flop valves, double collecting hopper & spouts to sample bags	1,200.00
M-23 1—Upright bran duster with motor & drive	1,100.00
M-23 1—Upright shorts duster with motor & drive	900.00
M-24 1—500-lb. batch mixer with motor & drive	1,000.00
M-25 2—Horizontal flour agitators	800.00
M-26 3—Chemical dry powder feeders	1,200.00
M-26 1—Pressure blower system for dry chemicals	600.00
M-27 1—1000-lb. hopper scale with dial for flour	1,600.00
M-28 1—Hi-pressure air conveyor with 5-way switch for flour	2,200.00
M-29 1—1000-lb. hopper scale with dial for feed	1,600.00
M-30 1—Hi-pressure air conveyor with 2-way switch for feed	700.00
M-31 1—Flour packer, 50 & 100-lb. bags with drive and 700-lb. bin	1,500.00
M-32 1—100-lb. bag scale with over & under indicator	300.00
M-34 1—Sewing machine	1,000.00
M-35 1—Entoleter for flour	1,200.00
M-36 1—vacuum cleaning system for mill, cleaning house and milling labs	4,000.00
M-37 1—Gravimetric belt feeder for mill & research.	2,000.00
M-38 1—Pre-fab spouting, valves, hand holes, elbows, Y joints	9,000.00
M-39 1—Air classifier, 1000 lb./hr.	10,000.00
M-40 1—Air conditioner, duct work & controls (chilled water & steam furnished)	5,000.00
M-41 1—Water spray humidifying system for roll flour with controls	1,000.00
M-42 4—15 cwt. bulk flour bins, 3' dia. x 6' high + hoppers	600.00
M-43 4—Flour feeders with variable speed drives	2,000.00
M-43 1—High pressure flour transfer system	1,700.00
M-44 4—Recording temperature relative humidity instruments	1,000.00
	$128,500.00
Mill wright labor	12,000.00
Electrical labor	7,000.00
Plumbing labor	5,000.00
	$153,500.00
+ 10% contingency	15,250.00
TOTAL	$168,750.00

Student Experimental and Research Laboratories

Experimental Milling Laboratory (Primarily for Student Training):	
8 Allis experimental mills (3 pr. rolls, 1 sifter & drive each) @ $7,500	$45,000.00
6 Toledo scales @ $400	2,400.00
1 Blender	150.00
1 Sifter, laboratory	350.00
	$47,900.00
Cleaning and Preparation Room:	
Tempering device	$ 150.00
Tag Heppenstall moisture meter	450.00
Steinlite	425.00
Dockage Tester (Carter)	825.00
Scourer (Forster)	350.00
Test weight apparatus	200.00
1 Toledo scale	400.00
1 Divider	200.00
	$ 3,000.00
Milling Technology Laboratory:	
2 Allis mills with 3 stands rolls each	$15,000.00
Sifters, laboratory size	450.00
Toledo scales	400.00
Rotap sifter	450.00
	$16,300.00
Milling Research Laboratory:	
MIAG Laboratory Conditioner	-on hand-
Multomat experimental mill, 3 break, 5 reduction	$15,000.00
	$15,000.00
TOTAL	$82,200.00
Unit Operations, Milling Technology & Research Laboratories:	
U-1 Gravimetric flour & mill stock feeder	$ 2,200.00
U-2 Single stands roller mills 9" x 6", spare rolls, etc.	2,800.00
U-3 Motor drive, variable speed, variable differential	1,200.00
U-5 2 x 12 sifter, variable speed & throw	3,500.00
U-6 Experimental purifier, variable speed, throw pitch, etc.	3,000.00
U-7 Air classifier, 0-60 microns, 60 lb./hr.	3,500.00
U-8 MIAG vari roll stand, vari speed, differential, etc.	3,900.00
U-9 Experimental pneumatic equipment	3,000.00
	$23,100.00
+ 10% contingency	2,310.00
TOTAL	$25,410.00

BENEFITS THAT CARRY NO PRICE TAG!

MILLERS who employ the products and processes of STERWIN CHEMICALS INC. are assured of two big extras . . . at no extra cost!

FIRST, there is the benefit of STERWIN's research. STERWIN's vast research facilities are constantly working to improve existing products and processes and to develop new ones for better, more economical flour treatment.

SECOND, a field force of technically trained specialists stands constantly ready to render on-the-spot, at-the-mill service. These specialists, calling on years of broad experience in every phase of flour treatment, answer questions, solve problems, help effect valuable savings in time, money and labor.

Yet these twin benefits carry no price tag. They are contributions which STERWIN makes with pride as part of its continuing effort to provide the very finest flour treatment to the millers of the U. S. and Canada.

IN CANADA:
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AURORA, ONTARIO

Sterwin Chemicals INC.
A Subsidiary of Sterling Drug Inc.
1450 BROADWAY, NEW YORK 18, N. Y.
SPECIALISTS IN FLOUR MATURING, BLEACHING AND ENRICHMENT

Report on Smut Prevalence in Pacific Northwest

EDITOR'S NOTE: This report is based on a survey conducted through the office of Merrill Sather, executive secretary, Pacific Northwest Grain Dealers Assn., Spokane, Wash. The report was prepared by C. S. Holton, pathologist, U.S. Department of Agriculture, regional smut research laboratory, Pullman, Wash.

About 65 million bushels of wheat representing 28 varieties (Table 1) were sampled in a survey for smut prevalence in the 1958 crop in the Pacific Northwest. This is more than one-half the estimated production (113,895,000 bu.) in the area covered by the survey and somewhat less than half the total production for the three Pacific Northwest states (Idaho, Oregon, Washington).

Less than 2 million bushels (1,664,434) graded smutty, which is 2.5% of the survey sample (Table 1). This is a decrease of 13.5 percentage points from the 1957 figure of 16%. In terms of the total wheat production for the three Pacific Northwest states 2.5% represents about 3,632,000 bu. smutty wheat. This contrasts with the 1957 figure of 17 million bushels of smutty wheat, a decrease in smutty wheat of more than 13 million bushels in 1958.

Eleven of the varieties sampled had no smut. These varieties were relatively minor in terms of total production, the survey sample covering less than 2 million bushels. The prevalence of smut in the remaining varieties ranged from a trace in Burt, Federation and Idaed to 100% in Triplet, represented by only 21,243 bu. Otherwise, Elmar, represented by over 5 million bushels, had the highest percentage (13.4) grading smutty. It was followed in turn by Hymar (8.4%), Golden (6.1%), Ridit (5.4%) and Elgin (5.1%), of which only Golden and Elgin were reported in significant amounts.

The bulk of the smutty wheat reported was in the varieties Elmar, Omar, and Elgin. These varieties represented about two-thirds of the survey sample and contributed 87% of the bushels grading smutty.

Omar was first in total volume reported, with over 33 million bushels, and although second in volume of smutty wheat it was among the lowest in percentage (1.2%) grading smutty.

The relatively high volume of smutty Omar can be discounted to some extent by the region-wide admixtures of Elmar and other volunteering club varieties, which invariably showed high percentages of smut-infected heads. The smut from these volunteer plants of the susceptible varieties contaminated the Omar at harvest, even though the Omar crop had been smut-free. Although an Omar race of smut is known to be present in the region, no more than a trace of smut has yet been reported on Omar plants of known identity in commercial fields. Thus, it seems possible that as the "volunteer Elmar" problem diminishes the incidence of smut in Omar may also diminish.

The relative prevalence of smut in the leading susceptible and resistant varieties of the region in 1958 is shown in Table 2, with comparative percentages for 1957 and 1956. The survey sample of the susceptible group was more than 8 million bushels and less than a half million bushels (4.8%) graded smutty, as compared with percentages of 6.1 and 19.7 in the two previous years. Thus, even in the susceptible varieties there is a downward trend in smut incidence.

The resistant group of varieties was represented by about 53 million bushels, of which only about 1% graded smutty. This contrasts with percentages of 19.8 and 35.6 in 1957 and 1956, respectively. This marked reduction was due mainly to the shift from Elmar to Omar and Burt. The classification of the resistant varieties into "Martin type" and "Other Types" (Table 2) shows greater smut prevalence in the former type. This reflects the smut race population of the region, which is made up primarily of the so-called "Martin factor"

(Turn to SMUT, page 18a)

Variety	Total Bushels	Bushels Smutty	Per Cent Smutty 1958	1957	1956
Omar	33,677,622	409,403	1.2	0.2	0.0
Elgin	5,778,316	298,210	5.1	3.0	30.7
Elmar	5,508,487	741,705	13.4	39.5	54.0
Brevor	4,434,542	35,563	0.8	0.6	5.5
Burt	4,052,647	794	Tr	0.0	0.0
Turkey	4,033,413	36,305	0.9	0.4	0.8
Golden	1,303,440	79,643	6.1	14.0	30.6
Requa	1,116,003	22,863	2.0	3.4	1.3
Columbia	787,090	1,004	0.1	0.0	--
Marfed	760,006	6,923	0.9	0.0	0.9
Rio	752,155	0	0.0	0.0	0.0
Baart	663,761	2,467	0.3	0.6	0.3
Idaed	457,102	270	Tr	0.3	0.6
Federation	415,772	285	Tr	1.9	3.0
Orfed	303,218	0	0.0	0.0	0.0
Commanche	219,482	0	0.0	1.5	0.0
Pilcraw	156,470	0	0.0	0.0	0.0
Wasatch	108,589	1,450	1.3	0.0	0.0
Major Bluestem	96,718	0	0.0	0.0	6.2
Rex	72,103	0	0.0	4.0	0.7
Ridit	58,088	3,226	5.4	0.2	94.8
Lemhi	46,550	0	0.0	0.0	0.0
Hymar	35,381	3,000	8.4	36.6	27.3
Unknown	24,769	0	0.0	0.0	--
Triplet	21,243	21,243	100.0	58.3	97.1
Fife	6,094	0	0.0	3.8	0.0
Spokane Chief	2,600	0	0.0	0.0	--
Red Russian	1,957	0	0.0	71.1	0.0
Marquis	321	0	0.0	0.0	7.7
TOTALS	64,919,517	1,664,434	2.5	16.0	26.7

Table 1. The relative prevalence of smut in wheat varieties of the Pacific Northwest in 1958 with comparative percentage for 1957 and 1956.

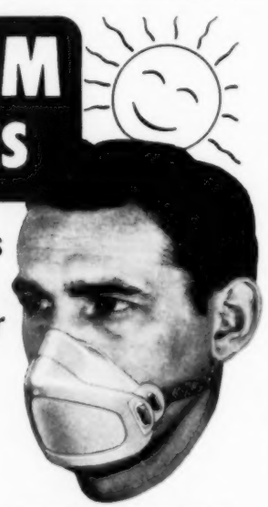
Need New Rolls?

In addition to our roll corrugating and grinding service for the flour milling industry, the Twin City Machine Co. also supplies new rolls, and we will be pleased to receive your inquiries.

TWIN CITY MACHINE CO.

Roll Corrugating and Grinding New Rolls
527 Second Avenue, S.E. Minneapolis Minn.

FLEX-A-FOAM DUST MASKS



Dust protection your workers will welcome and wear *in even the HOTTEST weather*

★ **Ideal for Hot Weather** Filter's porous action absorbs and actually exhales body heat.

★ Flex-A-Foam's lightweight (only 1 ounce complete) makes it cool and comfortable to wear — not hot and cumbersome like old-fashioned respirators.

★ Flex-A-Foam is easier to breathe and talk through than an ordinary pocket handkerchief — does away with that stuffy, smothered feeling.

Your best *Ounce of Protection* against Irritating Dust

UNMATCHED ECONOMY

Flex-A-Foam is the lowest priced *quality* respirator on the market today.

Flex-A-Foam's washable filter outlasts throw-away type by more than 100 to 1.

Fewer filter replacements with Flex-A-Foam Dust Masks mean fewer lost production hours.

Sample only $1.45 postpaid (Industrial price only)

FLEX-A-FOAM® DUST MASK

FLEXO PRODUCTS, INC. • Westlake, Ohio

For Mills, we recommend . . .

Talismanic

BELT DRESSINGS

Specialized for Your Industry

Belt Clinch No. 2 (liquid) and Bar Belt Dressing No. 3.

These dressings are preferred by 75% of our flour mill customers.

WRITE FOR GENEROUS SAMPLES

JOHN C. CHAMBERS CO.

1827 N. LeClaire Ave.
Chicago 39, Ill.

LONG WAY FROM HOME—Coming from the farthest distance to attend the recent Association of Operative Millers tecl nical conference and trade show at Chicago was Joshua Heller of Victory Mills, Ltd., Worchester, South Africa.

B-I-F Industries Mobile Belt Stream Weigher Touring Country

PROVIDENCE, R.I.—An actual working model of a belt stream weigher for the continuous weighing of dry materials is now touring the U.S. B-I-F Industries, Inc., of Providence, manufacturer of process instrumentation, equipment and systems for positive control of materials in motion, has announced that the display unit will visit major cities and remain in each of the company sales territories for one or two weeks.

The Omega Pneu-Weigh, a product of Omega Machine Co., division of B-I-F, is not a mock up, but an actual full size production model of one of the company's weighers designed for the process industries for accurately measuring and controlling flow of dry materials at low to medium rates. Industries using such equipment are flour and feed mills, food processors, fertilizer, plastics and chemical plants, water and sewage works, etc.

The weigher is mounted on tracks and is easily drawn out of a station wagon for display purposes. A small compressor supplies the measuring air, with the auto's spare tire being used as a storage tank. The demonstrator, using rollers to simulate dry loads, shows working features and advantages, such as wide measuring range, simplicity of installation and operation, high accuracy, continuous integration, direct reading totalizers, pneumatic sensing device, etc.

Here is the working model of a belt stream weigher that is now touring the U.S.

Financial Plan For Equipment Firms Announced

NEW YORK—A new plan will enable milling, baking and feed equipment manufacturers to set up full programs for installment sales of their income-producing equipment, obtain complete financing, and have the financing company handle all the customer credit, collection and paper work at no extra charge. The plan was released by Arthur F. Silbert, vice president of Standard Financial Corp., New York.

This program is available to manufacturers of income-producing milling and feed equipment in connection with their installment sales to trade customers. The financing company will furnish such manufacturers with the necessary contracts, credit applications and notes, will check customer credits anywhere in the country within three days, and assume the chore of collection—all without charge.

Equipment purchasers would be required to make only a down payment of 15% in cash or trade, the balance payable in 1-5 years. Standard Financial will advance to the manufacturer 90 to 100% of the gross amount of the customer's installment note, minus the minimal finance charge.

Offices and subsidiaries of Standard Financial which will handle credit applications and collections, are located in New York City, Elmira, N.Y., Philadelphia, Pittsburgh, Chicago, Los Angeles and Dallas.

FLOUR MILLS RECOVER
EXTRA PROFITS
with an IPI RECOVERY SYSTEM

Recovers Valuable Washer Solids

An IPI Recovery System provides a practical—and profitable—method of recovering wheat-wash water solids. These solids are a marketable feed supplement, with a protein and fat content comparable to mill-run or mill-feed. Operational tests prove that in eight days—or less—mills recover the equivalent weight of one hour's grind (a minimum of ½%).

Eliminates Sewage Problems

Removing solids from the washer water drastically reduces the cost of sewage disposal. When an optional second stage (water recovery) is added, *total sewage volume* is generally reduced by as much as 90% or more.

Eliminates Water Problems

The use of the optional second stage of an IPI Recovery System enables mills to recover wheat wash water for re-use —and results in saving up to 90% of city water volume.

Your mill can recover *extra* profits—and solve sewage and water problems—too. You may have any additional information you wish, without obligation.

SEND FOR FREE FOLDER

IPI Industrial Processes, Inc.
621 S.W. Morrison, Portland 4, Oregon

Worth Looking Into

New Products
New Services
New Literature

This reader service department announces the development of new and improved products, new services and new literature offered by manufacturers and suppliers. Claims made in this department are those of the firm concerned. Use the accompanying coupon to obtain the desired information.

No. 6916—Hydraulic Lift Truck

A hydraulic lift truck for inplant materials handling has been announced by Industrial Handling Equipment Co., Inc. The unit has a built-in hydraulic system that has wear resistant packings and takes a

minimum number of pump strokes to achieve a 5 in. lift, company literature said. Lowered height of forks is 3¼ in. and raised 8¼ in. The wheels roll on encased ball bearings and pivot 90° in both directions. Units are available in either 2,400 or 4,400 lb. capacities with 36, 42 or 48 in. fork lengths and 20½ or 27 in. width. For details, check No. 6916 on the coupon and mail.

No. 2129—Mixer Data Sheet

A data sheet giving information and specifications on the new Munson Mina-Mixer has been published recently by the Munson Mill Machinery Co., it was announced by T. Alun Powell, sales manager. The new data sheet describes the specific applications for which this machine was recently built. According to Mr. Powell, the mixer is, in effect, a small rotary batch mixer designed especially for laboratory experiments, pilot plant operations and small lot production runs. Complete specifications are listed on the data sheet, giving capacity, horsepower drive, approximate weight and the principle underlying the mixing operation. The data sheet may be obtained by checking No. 2129 on the coupon.

No. 7514—Plate Magnet

Stearns Magnetic Products announces three new models of Indox V plate magnets. The magnets are designed for installation in chutes, spouts, ducts, conveyors or other processing equipment for removing iron

junk from materials in process. The magnets are made in four sizes and styles with various dimensional differences within each of the four size groups. For additional information, check No. 7514 on the coupon and mail.

No. 9044—Safety Mask

A new safety mask, effective against toxic fumes, has been announced by Acme Protection Equipment Co. Four special features are described by the makers. One is the back mounting of the canister, assuring that its inlet is in the least contaminated air surrounding the operator. The canister pouch is adjustable to fit various sizes of canisters, the makers say. In case the operator may wish to use different canisters for various gases or desires to connect quickly to fresh canisters, the outfit offers a quick change feature with threaded canister necks. The quick change connection is also available at the facepiece so chin style canisters may be used if desired. Check No. 9044 on the coupon for a bulletin describing this equipment.

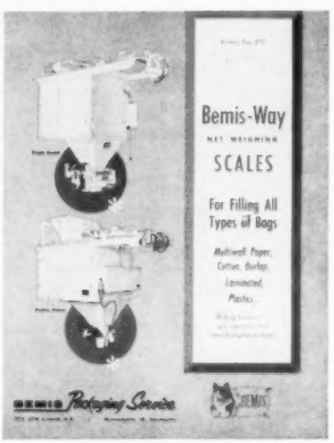
No. 9056—Power Shovel

A one man power shovel has been introduced by Seedburo Equipment Co. Designed for complete portability, the shovel has many built-in safety features, the company says. A push-button in the shovel handle controls the pulling action and functions as a "dead man" switch, giving positive control to the operator. If the operator releases the push-button, the pulling cycle stops instantly. According

to company literature, the unit is especially adaptable for flat storage buildings, feeding marine legs on barges and unloading truck grain, feed or fertilizer. Various scoop designs are available as standard equipment. Check No. 9056 and mail.

No. 9052—Flexible Bag Packer

A four-page bulletin describing its new "Bemis-Way Scale" has been produced by Bemis Bro. Bag Co. The product is said by its makers to be a flexible bag packer adjustable to handle free-flowing or semi-free-flowing products. It is made in either a single or duplex-scale model, they say. Further information from Bemis says the bagger can fill and weigh 25 to 200-lb. size multiwall paper, polyethylene or textile bags at speeds up to 18 bags a minute. Weight accuracy is within 2 ounces, Bemis says. A gravity bulk or vibrator bulk feed system is optional. Each packer is specially engineered



Send me information on the items marked:

- ☐ No. 2129—Data Sheet
- ☐ No. 6916—Truck
- ☐ No. 7514—Magnet
- ☐ No. 9044—Mask
- ☐ No. 9052—Packer
- ☐ No. 9056—Shovel

Others (list numbers) .....

NAME .....

COMPANY .....

ADDRESS .....

CLIP OUT — FOLD OVER ON THIS LINE — FASTEN (STAPLE, TAPE, GLUE) — MAIL

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REMEMBER TO ORDER
CHASE BAGS
There's None Better!

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Designers and Builders for Milling Companies
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Jess A. Meininger

VICE PRESIDENT—Jess A. Meininger has been elected vice president of production, quality control and sales service of the Trenton (Ill.) Milling Co., according to an announcement by Richard K. Hammel, president. Mr. Meininger had been manager of technical service for the milling industry for Victor Chemical Works, with whom he was associated for 27 years.

for specific products such as fertilizer and pesticides. Optional features include different bag holders, stainless steel product contact surfaces, corrosion-resistant paint and sewing machine pedestal and conveyors designed especially for this scale. The new bulletin contains operation and engineering specifications. It is available by checking No. 9052 on the coupon.

—BREAD IS THE STAFF OF LIFE—

BARLEY EXPORTS GAIN

WINNIPEG — Outward movement of Canadian barley in the current crop year continues ahead of last year, with a gain in overseas clearances more than offsetting smaller shipments to the U.S. Exports for the nine months ended April 30 totalled 46,265,000 bu. and of this 8,400,000 went to the U.S., compared with 17,096,000 out of an aggregate export movement of 42,183,000 bu.

SONS

(Continued from page 11a)

The scale proved so successful that the firm of Avery of Birmingham, bought the rights from Richardson to manufacture this scale, it was chiefly in this way that the firm of Avery entered the market for the manufacture of scales of this type.

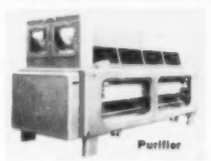
In 1902, Mr. Richardson went to the U.S. where he founded the Richardson Scale Co. Today it is among the largest manufacturers of weighing equipment in the world, with branches in many countries, manufacturing automatic weighers of all types, together with specialized equipment for the control and automatic proportioning of weighing systems.

Former instances I have given of millers' sons achieving distinction in other fields have been mainly concerned with past generations. If one wishes to quote an instance of this kind happening in the present one cannot do better than mention the name of Joseph F. Lockwood, son of a miller, whose mother was a miller's daughter. Her parents, grandparents and beyond, had been millers for generations. Mr. Lockwood, one of a family of four boys, as was to be expected, was brought up as a miller. Later he changed his occupation to that of a milling engineer, finally becoming head of one of the largest firms of flour milling engineers in the world. Not content with this dazzling success, and at a time when most people are beginning to think of retirement, he suddenly changed his occupation, again to something of an entirely different nature, and within a very short time became what the editor of one financial paper called "boss" of Electrical and Musical Industries, Ltd.

The flour milling industry has also produced another illustrious son of a famous father, J. Arthur Rank (now Lord Rank), whose incursions into the film world are too well known to mention here.

If one cares to go further back into history, one can find plenty of evidence of brilliant talent amongst sons of millers such as, for instance, Rembrandt, the famous artist, son of a Dutch miller, which no doubt explains his fondness for including the family windmill in some of his paintings. There is also another artist who achieved considerable fame as one of England's great landscape painters, John Constable, son of a Suffolk miller, who immortalized the family mill in one of his paintings. Another name of world renown was that of Enrico Caruso, the celebrated operatic tenor, son of an Italian mill worker. One could go on adding to the list of names too numerous to mention here. The milling industry should feel proud of its distinguished sons, and perhaps one day some interested person will find time to compile a record of these famous men.

Roller Mill


Purifier

Plan-O-Star Sifter

Impact Finisher

Pneumatic System

Washer and Stoner

Why Buhler-Designed Mills are world's most efficient

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As a matter of fact, more mills are now operating with BUHLER *Equipment and* BUHLER *System than with any other.*

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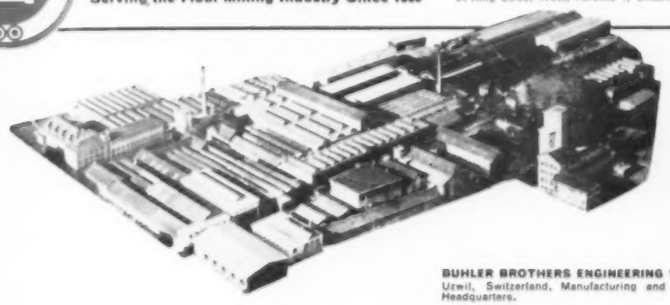

BUHLER BROTHERS ENGINEERING WORKS,
Uzwil, Switzerland, Manufacturing and Research Headquarters.

Susceptible Varieties	Total Bushels	Bushels Smutty	Per Cent Smutty 1958	1957	1956
Elgin	5,778,316	298,210	5.1	3.8	30.7
Golden	1,303,448	79,643	6.1	14.0	30.6
Requa	1,116,003	22,863	2.0	3.4	1.3
Federation	415,772	285	.07	1.9	3.0
Triplet	21,243	21,243	100.00	58.3	97.1
TOTALS	8,634,782	422,244	4.8	6.1	19.7
Resistant Varieties					
"Martin Type"					
Elmar	5,508,487	741,705	13.4	39.5	54.0
Rex	72,103	0	0.0	4.0	0.7
Hymar	35,381	3,000	8.4	36.6	27.3
Sub-Totals	5,615,971	744,705	13.2	--	--
"Other Types"					
Omar	33,677,622	409,403	1.2	0.2	--
Brevor	4,434,542	35,563	0.8	0.6	5.5
Burt	4,052,647	794	0.0	0.0	--
Turkey	4,033,413	36,385	0.9	0.4	0.8
Columbia	787,090	1,004	0.1	0.0	--
Orfed	303,218	0	0.0	0.0	0.0
Wasatch	108,589	1,450	1.3	0.0	--
Ridit	58,888	3,226	5.4	0.2	94.8
Sub-Totals	47,456,009	487,825	1.0	--	--

Table 2. The relative prevalence of smut in leading susceptible and resistant varieties in 1958 with comparative percentages for 1957 and 1958.

SMUT

(Continued from page 14a)

races. Even in these varieties, however, there was a marked reduction in smut incidence in 1958, as compared with the previous two years (Table 2). The relatively greater effectiveness of "Other types" of resistance in controlling smut in this region is clearly shown by the low incidence (1%) of smut in these varieties (Table 2).

The Washington survey sampled over 48 million bushels, of which 2.8% graded smutty. The Oregon survey covered about 12½ million bushels, with 1.1% grading smutty. Less than 4 million bushels were reported in Idaho and 4% graded smutty. These state percentages compared with 17.6, 12.4 and 9.7 for Washington, Oregon and Idaho, respectively, in 1957.

Omar was the leading variety in all threee states. However, its margin over Brevor is only slight in Idaho. Idaho's top position in percentage of smut incidence reflects in part the relatively high incidence of smut in Omar and Brevor, the two leading varieties. The marked reduction of smut incidence in Washington is primarily attributable to the preponderance of Omar production, together with a greatly reduced smut incidence on Elmar, third in production.

The monetary loss due to smut in 1958 is estimated at less than one-half million dollars ($308 000), down from about $3 million in 1957.

Assuming continued growing of the highly smut-resistant varieties and improved seed treatment practices, the incidence of smut in future years should be further reduced. We seem to have at our disposal the best methods made available to date for smut control in winter wheat in the Pacific Northwest. The judicious utilization of these methods should reduce the incidence of wheat smut to a minor status in the immediate future, although its potentiality as a major production factor will remain a threat for the indefinite future.

—BREAD IS THE STAFF OF LIFE—

DAM CONSTRUCTION STARTS

WINNIPEG—Official start of construction of the South Saskatchewan River dam was marked May 27, when Prime Minister John Diefenbaker detonated a half ton of dynamite at the site.

New Jersey Flour Mills To Install Bulk Feed Equipment, Bins

CLIFTON, N.J.—The New Jersey Flour Mills Co. of Clifton has announced through its president, Lawrence F. Orbe, Jr., that it has contracted with Sprout, Waldron & Co., Inc. of Muncy, Pa. for the installation of bulk feed equipment and bins.

When completed the installation will provide for 100,000 lb. of bran and 100,000 lb. of flour middlings and the project calls for the loading out of these mill feeds at the rate of 30 000 lb. per hour. The entire operation will be pneumatically handled through a centrally located control panel, electronically operated.

Work has already begun on the project and it is expected that the completion date will be about Sept. 1. The Sprout-Waldron firm engineered and installed the New Jersey's bulk flour plant which was completed in 1956.

—BREAD IS THE STAFF OF LIFE—

GRAIN FIRM INCORPORATES

OKLAHOMA CITY, OKLA.—Watts Grain, Inc., Tulsa, has been incorporated with capital stock of $50,000 and 50 years existence. Incorporators are Carl D. Hall, Jr., Dorothy D. McCormick and C. A. Kothe, all of Tulsa.

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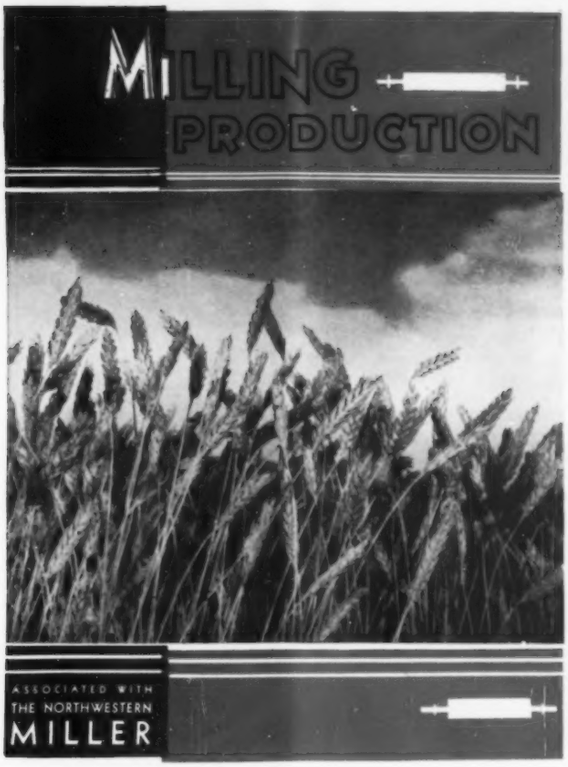

TRIPLE YOUR ADVERTISING EFFECTIVENESS

1. WORKING CIRCULATION —Studies of flour manufacture show that about 300 of the mills in this country produce 98% of the flour. Milling Production with its controlled circulation reaches more than 1,000 key men in these important flour mills. This working circulation provides contact each month with the people who directly or indirectly control the buying—superintendents, operative millers, chemists and plant managers. *There is no waste circulation—only working circulation* — and you are assured of reaching your potential customers in the most productive mills.

2. LEADERSHIP MAKES READERSHIP — Readership surveys and unsolicited correspondence from its readers attest to the editorial leadership of Milling Production. That editorial leadership is held by complete words-and-pictures reports of the latest milling technology, current news, features and complete coverage of the activities of the industry's two technical associations. *The real price the reader of a publication pays is the amount of time he puts in reading that journal.* Over one half of the readers of Milling Production have requested that it be sent to their homes so that they may enjoy uninterrupted reading pleasure.

3. DOUBLE-DUTY DOLLARS —Money spent for advertising in Milling Production does double duty. In addition to reaching the production personnel, the advertiser's message is read in the Milling Production Section of The Northwestern Miller by the executives who approve purchase orders. *No other advertising medium in the flour milling industry offers this double-duty feature of reaching both groups* — mill technologists and executives—with the same advertising message and for the cost of one advertisement. Take advantage of this 100% coverage through one double-duty advertising contract.

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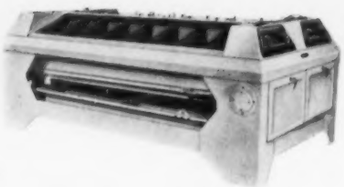

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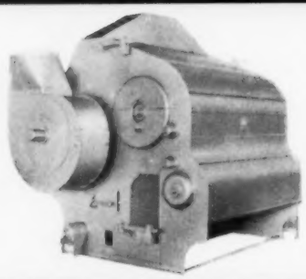

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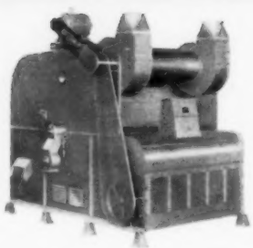

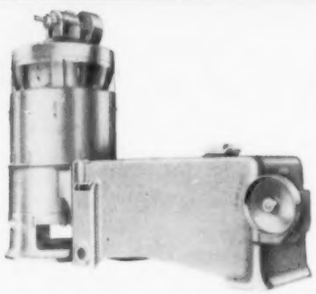

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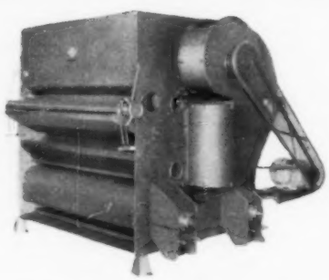

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